

SEQUENCE LISTING



<100> Sung, Wing
<120> Xylanases with Enhanced Thermophilicity and Alkalophilicity
<130> 07121.0003U1

<160> 54 ✓

<170> PatentIn version 3.0

<210> 1

<211> 184

<212> PRT

<213> Aspergillus niger

<400> 1

Ser Ala Gly Ile Asn Tyr Val Gln Asn Tyr Asn Gly Asn Leu Gly Asp
1 5 10 15
Phe Thr Tyr Asp Glu Ser Ala Gly Thr Phe Ser Met Tyr Trp Glu Asp
20 25 30
Gly Val Ser Ser Asp Phe Val Val Gly Leu Gly Trp Thr Thr Gly Ser
35 40 45
Ser Asn Ala Ile Thr Tyr Ser Ala Glu Tyr Ser Ala Ser Gly Ser Ser
50 55 60
Ser Tyr Leu Ala Val Tyr Gly Trp Val Asn Tyr Pro Gly Ala Glu Tyr
65 70 75 80
Tyr Ile Val Glu Asp Tyr Gly Asp Tyr Asn Pro Cys Ser Ser Ala Thr
85 90 95
Ser Leu Gly Thr Val Tyr Ser Asp Gly Ser Thr Tyr Gln Val Cys Thr
100 105 110
Asp Thr Arg Ile Asn Glu Pro Ser Ile Thr Gly Thr Ser Thr Phe Thr
115 120 125
Gln Tyr Phe Ser Val Arg Glu Ser Thr Arg Thr Ser Gly Thr Val Thr
130 135 140
Val Ala Asn His Phe Asn Phe Trp Ala Gln His Gly Phe Gly Asn Ser
145 150 155 160

Asp Phe Asn Tyr Gln Val Met Ala Val Glu Ala Trp Ser Gly Ala Gly
 165 170 175

Ser Ala Ser Val Thr Ile Ser Ser
 180

<210> 2

<211> 185

<212> PRT

<213> Aspergillus tubigensis

<400> 2

Ser Ala Gly Ile Asn Tyr Val Gln Asn Tyr Asn Gln Asn Leu Gly Asp
 1 5 10 15

Phe Thr Tyr Asp Glu Ser Ala Gly Thr Phe Ser Met Tyr Trp Glu Asp
 20 25 30

Gly Val Ser Ser Asp Phe Val Val Gly Leu Gly Gly Trp Thr Thr Gly
 35 40 45

Ser Ser Asn Ala Ile Thr Tyr Ser Ala Glu Tyr Ser Ala Ser Gly Ser
 50 55 60

Ala Ser Tyr Leu Ala Val Tyr Gly Trp Val Asn Tyr Pro Gln Ala Glu
 65 70 75 80

Tyr Tyr Ile Val Glu Asp Tyr Gly Asp Tyr Asn Pro Cys Ser Ser Ala
 85 90 95

Thr Ser Leu Gly Thr Val Tyr Ser Asp Gly Ser Thr Tyr Gln Val Cys
 100 105 110

Thr Asp Thr Arg Ile Asn Glu Pro Ser Ile Thr Gly Thr Ser Thr Phe
 115 120 125

Thr Gln Tyr Phe Ser Val Arg Glu Ser Thr Arg Thr Ser Gly Thr Val
 130 135 140

Thr Val Ala Asn His Phe Asn Phe Trp Ala His His Gly Phe His Asn
 145 150 155 160

Ser Asp Phe Asn Tyr Gln Val Val Ala Val Glu Ala Trp Ser Gly Ala
 165 170 175

Gly Ser Ala Ala Val Thr Ile Ser Ser
 180 185

<210> 3

<211> 185

<212> PRT

<213> Bacillus circulans

<400> 3

Ala Ser Thr Asp Tyr Trp Gln Asn Trp Thr Asp Gly Gly Gly Ile Val
 1 5 10 15

Asn Ala Val Asn Gly Ser Gly Gly Asn Tyr Ser Val Asn Trp Ser Asn
 20 25 30

Thr Gly Asn Phe Val Val Gly Lys Gly Trp Thr Thr Gly Ser Pro Phe
 35 40 45

Arg Thr Ile Asn Tyr Asn Ala Gly Val Trp Ala Pro Asn Gly Asn Gly
 50 55 60

Tyr Leu Thr Leu Tyr Gly Trp Thr Arg Ser Pro Leu Ile Glu Tyr Tyr
 65 70 75 80

Val Val Asp Ser Trp Gly Thr Tyr Arg Pro Thr Gly Thr Tyr Lys Gly
 85 90 95

Thr Val Lys Ser Asp Gly Gly Thr Tyr Asp Ile Tyr Thr Thr Thr Arg
 100 105 110

Tyr Asn Ala Pro Ser Ile Asp Gly Asp Arg Thr Thr Phe Thr Gln Tyr
 115 120 125

Trp Ser Val Arg Gln Ser Lys Arg Pro Thr Gly Ser Asn Ala Thr Ile
 130 135 140

Thr Phe Thr Asn His Val Asn Ala Trp Lys Ser His Gly Met Asn Leu
 145 150 155 160

Gly Ser Asn Trp Ala Tyr Gln Val Met Ala Thr Glu Gly Tyr Gln Ser
 165 170 175

Ser Gly Ser Ser Asn Val Thr Val Trp
 180 185

<210> 4

<211> 201

<212> PRT

<213> Bacillus pumilus

<400> 4

Arg Thr Ile Thr Asn Asn Glu Met Gly Asn His Ser Gly Tyr Asp Tyr
 1 5 10 15

Glu Leu Trp Lys Asp Tyr Gly Asn Thr Ser Met Thr Leu Asn Asn Gly
 20 25 30
 Gly Ala Phe Ser Ala Gly Trp Asn Asn Ile Gly Asn Ala Leu Phe Arg
 35 40 45
 Lys Gly Lys Lys Phe Asp Ser Thr Arg Thr His His Gln Leu Gly Asn
 50 55 60
 Ile Ser Ile Asn Tyr Asn Ala Ser Phe Asn Pro Ser Gly Asn Ser Tyr
 65 70 75 80
 Leu Cys Val Tyr Gly Trp Thr Gln Ser Pro Leu Ala Glu Tyr Tyr Ile
 85 90 95
 Val Asp Ser Trp Gly Thr Tyr Arg Pro Thr Gly Ala Tyr Lys Gly Ser
 100 105 110
 Phe Tyr Ala Asp Gly Gly Thr Tyr Asp Ile Tyr Glu Thr Thr Arg Val
 115 120 125
 Asn Gln Pro Ser Ile Ile Gly Ile Ala Thr Phe Lys Gln Tyr Trp Ser
 130 135 140
 Val Arg Gln Thr Lys Arg Thr Ser Gly Thr Val Ser Val Ser Ala His
 145 150 155 160
 Phe Arg Lys Trp Glu Ser Leu Gly Met Pro Met Gly Lys Met Tyr Glu
 165 170 175
 Thr Ala Phe Thr Val Glu Gly Tyr Gln Ser Ser Gly Ser Ala Asn Val
 180 185 190
 Met Thr Asn Gln Leu Phe Ile Gly Asn
 195 200

<210> 5

<211> 185

<212> PRT

<213> Bacillus subtilus

<400> 5

Ala Ser Thr Asp Tyr Trp Gln Asn Trp Thr Asp Gly Gly Gly Ile Val
 1 5 10 15
 Asn Ala Val Asn Gly Ser Gly Gly Asn Tyr Ser Val Asn Trp Ser Asn
 20 25 30
 Thr Gly Asn Phe Val Val Gly Lys Gly Trp Thr Thr Gly Ser Pro Phe
 35 40 45

Arg Thr Ile Asn Tyr Asn Ala Gly Val Trp Ala Pro Asn Gly Asn Gly
50 55 60

Tyr Leu Thr Leu Tyr Gly Trp Thr Arg Ser Pro Leu Ile Glu Tyr Tyr
65 70 75 80

Val Val Asp Ser Trp Gly Thr Tyr Arg Pro Thr Gly Thr Tyr Lys Gly
85 90 95

Thr Val Lys Ser Asp Gly Gly Thr Tyr Asp Ile Tyr Thr Thr Thr Arg
100 105 110

Tyr Asn Ala Pro Ser Ile Asp Gly Asp Arg Thr Thr Phe Thr Gln Tyr
115 120 125

Trp Ser Val Arg Gln Ser Lys Arg Pro Thr Gly Ser Asn Ala Thr Ile
130 135 140

Thr Phe Ser Asn His Val Asn Ala Trp Lys Ser His Gly Met Asn Leu
145 150 155 160

Gly Ser Asn Trp Ala Tyr Gln Val Met Ala Thr Glu Gly Tyr Gln Ser
165 170 175

Ser Gly Ser Ser Asn Val Thr Val Trp
180 185

<210> 6

<211> 211

<212> PRT

<213> Clostridium acetobutylicum

<400> 6

Ser Ala Phe Asn Thr Gln Ala Ala Pro Lys Thr Ile Thr Ser Asn Glu
1 5 10 15

Ile Gly Val Asn Gly Gly Tyr Asp Tyr Glu Leu Trp Lys Asp Tyr Gly
20 25 30

Asn Thr Ser Met Thr Leu Lys Asn Gly Gly Ala Phe Ser Cys Gln Trp
35 40 45

Ser Asn Ile Gly Asn Ala Leu Phe Arg Lys Gly Lys Lys Phe Asn Asp
50 55 60

Thr Gln Thr Tyr Lys Gln Leu Gly Asn Ile Ser Val Asn Tyr Asn Cys
65 70 75 80

Asn Tyr Gln Pro Tyr Gly Asn Ser Tyr Leu Cys Val Tyr Gly Trp Thr
85 90 95

Ser Ser Pro Leu Val Glu Tyr Tyr Ile Val Asp Ser Trp Gly Ser Trp
 100 105 110
 Arg Pro Pro Gly Gly Thr Ser Lys Gly Thr Ile Thr Val Asp Gly Gly
 115 120 125
 Ile Tyr Asp Ile Tyr Glu Thr Thr Arg Ile Asn Gln Pro Ser Ile Gln
 130 135 140
 Gly Asn Thr Thr Phe Lys Gln Tyr Trp Ser Val Arg Arg Thr Lys Arg
 145 150 155 160
 Thr Ser Gly Thr Ile Ser Val Ser Lys His Phe Ala Ala Trp Glu Ser
 165 170 175
 Lys Gly Met Pro Leu Gly Lys Met His Glu Thr Ala Phe Asn Ile Glu
 180 185 190
 Gly Tyr Gln Ser Ser Gly Lys Ala Asp Val Asn Ser Met Ser Ile Asn
 195 200 205
 Ile Gly Lys
 210

<210> 7

<211> 206

<212> PRT

<213> Clostridium stercocrarium

<400> 7

Gly Arg Ile Ile Tyr Asp Asn Glu Thr Gly Thr His Gly Gly Tyr Asp
 1 5 10 15
 Tyr Glu Leu Trp Lys Asp Tyr Gly Asn Thr Ile Met Glu Leu Asn Asp
 20 25 30
 Gly Gly Thr Phe Ser Cys Gln Trp Ser Asn Ile Gly Asn Ala Leu Phe
 35 40 45
 Arg Lys Gly Arg Lys Phe Asn Ser Asp Lys Thr Tyr Gln Glu Leu Gly
 50 55 60
 Asp Ile Val Val Glu Tyr Gly Cys Asp Tyr Asn Pro Asn Gly Asn Ser
 65 70 75 80
 Tyr Leu Cys Val Tyr Gly Trp Thr Arg Asn Phe Leu Val Glu Tyr Tyr
 85 90 95
 Ile Val Glu Ser Trp Gly Ser Trp Arg Pro Pro Gly Ala Thr Pro Lys
 100 105 110

Gly Thr Ile Thr Gln Trp Met Ala Gly Thr Tyr Glu Ile Tyr Glu Thr
115 120 125

Thr Arg Val Asn Gln Pro Ser Ile Asp Gly Thr Ala Thr Phe Gln Gln
130 135 140

Tyr Trp Ser Val Arg Thr Ser Lys Arg Thr Ser Gly Thr Ile Ser Val
145 150 155 160

Thr Glu His Phe Lys Gln Trp Glu Arg Met Gly Met Arg Met Gly Lys
165 170 175

Met Tyr Glu Val Ala Leu Thr Val Glu Gly Tyr Gln Ser Ser Gly Tyr
180 185 190

Ala Asn Val Tyr Lys Asn Glu Ile Arg Ile Gly Ala Asn Pro
195 200 205

<210> 8

<211> 211

<212> PRT

<213> Ruminococcus flavefaciens

<400> 8

Ser Ala Ala Asp Gln Gln Thr Arg Gly Asn Val Gly Gly Tyr Asp Tyr
1 5 10 15

Glu Met Trp Asn Gln Asn Gly Gln Gly Gln Ala Ser Met Asn Pro Gly
20 25 30

Ala Gly Ser Phe Thr Cys Ser Trp Ser Asn Ile Glu Asn Phe Leu Ala
35 40 45

Arg Met Gly Lys Asn Tyr Asp Ser Gln Lys Lys Asn Tyr Lys Ala Phe
50 55 60

Gly Asn Ile Val Leu Thr Tyr Asp Val Glu Tyr Thr Pro Arg Gly Asn
65 70 75 80

Ser Tyr Met Cys Val Tyr Gly Trp Thr Arg Asn Pro Leu Met Glu Tyr
85 90 95

Tyr Ile Val Glu Gly Trp Gly Asp Trp Arg Pro Pro Gly Asn Asp Gly
100 105 110

Glu Val Lys Gly Thr Val Ser Ala Asn Gly Asn Thr Tyr Asp Ile Arg
115 120 125

Lys Thr Met Arg Tyr Asn Gln Pro Ser Leu Asp Gly Thr Ala Thr Phe
130 135 140

Pro Gln Tyr Trp Ser Val Arg Gln Thr Ser Gly Ser Ala Asn Asn Gln
 145 150 155 160

Thr Asn Tyr Met Lys Gly Thr Ile Asp Val Ser Lys His Phe Asp Ala
 165 170 175

Trp Ser Ala Ala Gly Leu Asp Met Ser Gly Thr Leu Tyr Glu Val Ser
 180 185 190

Leu Asn Ile Glu Gly Tyr Arg Ser Asn Gly Ser Ala Asn Val Lys Ser
 195 200 205

Val Ser Val
 210

<210> 9

<211> 197

<212> PRT

<213> Schizophyllum commune

<400> 9

Ser Gly Thr Pro Ser Ser Thr Gly Thr Asp Gly Gly Tyr Tyr Tyr Ser
 1 5 10 15

Trp Trp Thr Asp Gly Ala Gly Asp Ala Thr Tyr Gln Asn Asn Gly Gly
 20 25 30

Gly Ser Tyr Thr Leu Thr Trp Ser Gly Asn Asn Gly Asn Leu Val Gly
 35 40 45

Gly Lys Gly Trp Asn Pro Gly Ala Ala Ser Arg Ser Ile Ser Tyr Ser
 50 55 60

Gly Thr Tyr Gln Pro Asn Gly Asn Ser Tyr Leu Ser Val Tyr Gly Trp
 65 70 75 80

Thr Arg Ser Ser Leu Ile Glu Tyr Tyr Ile Val Glu Ser Tyr Gly Ser
 85 90 95

Tyr Asp Pro Ser Ser Ala Ala Ser His Lys Gly Ser Val Thr Cys Asn
 100 105 110

Gly Ala Thr Tyr Asp Ile Leu Ser Thr Trp Arg Tyr Asn Ala Pro Ser
 115 120 125

Ile Asp Gly Thr Gln Thr Phe Glu Gln Phe Trp Ser Val Arg Asn Pro
 130 135 140

Lys Lys Ala Pro Gly Gly Ser Ile Ser Gly Thr Val Asp Val Gln Cys
 145 150 155 160

His Phe Asp Ala Trp Lys Gly Leu Gly Met Asn Leu Gly Ser Glu His
 165 170 175

Asn Tyr Gln Ile Val Ala Thr Glu Gly Tyr Gln Ser Ser Gly Thr Ala
 180 185 190

Thr Ile Thr Val Thr
 195

<210> 10

<211> 191

<212> PRT

<213> Streptomyces lividans Xyl B

<400> 10

Asp Thr Val Val Thr Thr Asn Gln Glu Gly Thr Asn Asn Gly Tyr Tyr
 1 5 10 15

Tyr Ser Phe Trp Thr Asp Ser Gln Gly Thr Val Ser Met Asn Met Gly
 20 25 30

Ser Gly Gly Gln Tyr Ser Thr Ser Trp Arg Asn Thr Gly Asn Phe Val
 35 40 45

Ala Gly Lys Gly Trp Ala Asn Gly Gly Arg Arg Thr Val Gln Tyr Ser
 50 55 60

Gly Ser Phe Asn Pro Ser Gly Asn Ala Tyr Leu Ala Leu Tyr Gly Trp
 65 70 75 80

Thr Ser Asn Pro Leu Val Glu Tyr Tyr Ile Val Asp Asn Trp Gly Thr
 85 90 95

Tyr Arg Pro Thr Gly Glu Tyr Lys Gly Thr Val Thr Ser Asp Gly Gly
 100 105 110

Thr Tyr Asp Ile Tyr Lys Thr Thr Arg Val Asn Lys Pro Ser Val Glu
 115 120 125

Gly Thr Arg Thr Phe Asp Gln Tyr Trp Ser Val Arg Gln Ser Lys Arg
 130 135 140

Thr Gly Gly Thr Ile Thr Thr Gly Asn His Phe Asp Ala Trp Ala Arg
 145 150 155 160

Ala Gly Met Pro Leu Gly Asn Phe Ser Tyr Tyr Met Ile Asn Ala Thr
 165 170 175

Glu Gly Tyr Gln Ser Ser Gly Thr Ser Ser Ile Asn Val Gly Gly
 180 185 190

<210> 11

<211> 191

<212> PRT

<213> Streptomyces lividans Xyl C

<400> 11

Ala	Thr	Thr	Ile	Thr	Thr	Asn	Gln	Thr	Gly	Thr	Asp	Gly	Met	Tyr	Tyr
1				5					10					15	

Ser	Phe	Trp	Thr	Asp	Gly	Gly	Gly	Ser	Val	Ser	Met	Thr	Leu	Asn	Gly
			20					25					30		

Gly	Gly	Ser	Tyr	Ser	Thr	Gln	Trp	Thr	Asn	Cys	Gly	Asn	Phe	Val	Ala
		35					40					45			

Gly	Lys	Gly	Trp	Ser	Thr	Gly	Asp	Gly	Asn	Val	Arg	Tyr	Asn	Gly	Tyr
	50					55					60				

Phe	Asn	Pro	Val	Gly	Asn	Gly	Tyr	Gly	Cys	Leu	Tyr	Gly	Trp	Thr	Ser
65					70					75					80

Asn	Pro	Leu	Val	Glu	Tyr	Tyr	Ile	Val	Asp	Asn	Trp	Gly	Ser	Tyr	Arg
				85					90					95	

Pro	Thr	Gly	Thr	Tyr	Lys	Gly	Thr	Val	Ser	Ser	Asp	Gly	Gly	Thr	Tyr
			100					105					110		

Asp	Ile	Tyr	Gln	Thr	Thr	Arg	Tyr	Asn	Ala	Pro	Ser	Val	Glu	Gly	Thr
	115						120						125		

Lys	Thr	Phe	Gln	Gln	Tyr	Trp	Ser	Val	Arg	Gln	Ser	Lys	Val	Thr	Ser
	130					135						140			

Gly	Ser	Gly	Thr	Ile	Thr	Thr	Gly	Asn	His	Phe	Asp	Ala	Trp	Ala	Arg
145					150					155					160

Ala	Gly	Met	Asn	Met	Gly	Gln	Phe	Arg	Tyr	Tyr	Met	Ile	Asn	Ala	Thr
				165					170					175	

Glu	Gly	Tyr	Gln	Ser	Ser	Gly	Ser	Ser	Asn	Ile	Thr	Val	Ser	Gly	
			180					185					190		

<210> 12

<211> 189

<212> PRT

<213> Streptomyces sp. No. 36a

<400> 12

Ala Thr Thr Ile Thr Asn Glu Thr Gly Tyr Asp Gly Met Tyr Tyr Ser
 1 5 10 15
 Phe Trp Thr Asp Gly Gly Gly Ser Val Ser Met Thr Leu Asn Gly Gly
 20 25 30
 Gly Ser Tyr Ser Thr Arg Trp Thr Asn Cys Gly Asn Phe Val Ala Gly
 35 40 45
 Lys Gly Trp Ala Asn Gly Gly Arg Arg Thr Val Arg Tyr Thr Gly Trp
 50 55 60
 Phe Asn Pro Ser Gly Asn Gly Tyr Gly Cys Leu Tyr Gly Trp Thr Ser
 65 70 75 80
 Asn Pro Leu Val Glu Tyr Tyr Ile Val Asp Asn Trp Gly Ser Tyr Arg
 85 90 95
 Pro Thr Gly Glu Thr Arg Gly Thr Val His Ser Asp Gly Gly Thr Tyr
 100 105 110
 Asp Ile Tyr Lys Thr Thr Arg Tyr Asn Ala Pro Ser Val Glu Ala Pro
 115 120 125
 Ala Ala Phe Asp Gln Tyr Trp Ser Val Arg Gln Ser Lys Val Thr Ser
 130 135 140
 Gly Thr Ile Thr Thr Gly Asn His Phe Asp Ala Trp Ala Arg Ala Gly
 145 150 155 160
 Met Asn Met Gly Asn Phe Arg Tyr Tyr Met Ile Asn Ala Thr Glu Gly
 165 170 175
 Tyr Gln Ser Ser Gly Ser Ser Thr Ile Thr Val Ser Gly
 180 185

<210> 13

<211> 189

<212> PRT

<213> Thermomonospora fusca

<400> 13

Ala Val Thr Ser Asn Glu Thr Gly Tyr His Asp Gly Tyr Phe Tyr Ser
 1 5 10 15
 Phe Trp Thr Asp Ala Pro Gly Thr Val Ser Met Glu Leu Gly Pro Gly
 20 25 30

Gly Asn Tyr Ser Thr Ser Trp Arg Asn Thr Gly Asn Phe Val Ala Gly
35 40 45

Lys Gly Trp Ala Thr Gly Gly Arg Arg Thr Val Thr Tyr Ser Ala Ser
50 55 60

Phe Asn Pro Ser Gly Asn Ala Tyr Leu Thr Leu Tyr Gly Trp Thr Arg
65 70 75 80

Asn Pro Leu Val Glu Tyr Tyr Ile Val Glu Ser Trp Gly Thr Tyr Arg
85 90 95

Pro Thr Gly Thr Tyr Met Gly Thr Val Thr Thr Asp Gly Gly Thr Tyr
100 105 110

Asp Ile Tyr Lys Thr Thr Arg Tyr Asn Ala Pro Ser Ile Glu Gly Thr
115 120 125

Arg Thr Phe Asp Gln Tyr Trp Ser Val Arg Gln Ser Lys Arg Thr Ser
130 135 140

Gly Thr Ile Thr Ala Gly Asn His Phe Asp Ala Trp Ala Arg His Gly
145 150 155 160

Met His Leu Gly Thr His Asp Tyr Met Ile Met Ala Thr Glu Gly Tyr
165 170 175

Gln Ser Ser Gly Ser Ser Asn Val Thr Leu Gly Thr Ser
180 185

<210> 14

<211> 190

<212> PRT

<213> Trichoderma harzianum

<400> 14

Gln Thr Ile Gly Pro Gly Thr Gly Tyr Ser Asn Gly Tyr Tyr Tyr Ser
1 5 10 15

Tyr Trp Asn Asp Gly His Ala Gly Val Thr Tyr Thr Asn Gly Gly Gly
20 25 30

Gly Ser Phe Thr Val Asn Trp Ser Asn Ser Gly Asn Phe Val Gly Gly
35 40 45

Lys Gly Trp Gln Pro Gly Thr Lys Asn Lys Val Ile Asn Phe Ser Gly
50 55 60

Ser Tyr Asn Pro Asn Gly Asn Ser Tyr Leu Ser Ile Tyr Gly Trp Ser
65 70 75 80

Arg Asn Pro Leu Ile Glu Tyr Tyr Ile Val Glu Asn Phe Gly Thr Tyr
85 90 95

Asn Pro Ser Thr Gly Ala Thr Lys Leu Gly Glu Val Thr Ser Asp Gly
100 105 110

Ser Val Tyr Asp Ile Tyr Arg Thr Gln Arg Val Asn Gln Pro Ser Ile
115 120 125

Ile Gly Thr Ala Thr Phe Tyr Gln Tyr Trp Ser Val Arg Arg Asn His
130 135 140

Arg Ser Ser Gly Ser Val Asn Thr Ala Asn His Phe Asn Ala Trp Ala
145 150 155 160

Ser His Gly Leu Thr Leu Gly Thr Met Asp Tyr Gln Ile Val Ala Val
165 170 175

Glu Gly Tyr Phe Ser Ser Gly Ser Ala Ser Ile Thr Val Ser
180 185 190

<210> 15

<211> 178

<212> PRT

<213> Trichoderma reesei Xyl I

<400> 15

Ala Ser Ile Asn Tyr Asp Gln Asn Tyr Gln Thr Gly Gly Gln Val Ser
1 5 10 15

Tyr Ser Pro Ser Asn Thr Gly Phe Ser Val Asn Trp Asn Thr Gln Asp
20 25 30

Asp Phe Val Val Gly Val Gly Trp Thr Thr Gly Ser Ser Ala Pro Ile
35 40 45

Asn Phe Gly Gly Ser Phe Ser Val Asn Ser Gly Thr Gly Leu Leu Ser
50 55 60

Val Tyr Gly Trp Ser Thr Asn Pro Leu Val Glu Tyr Tyr Ile Met Glu
65 70 75 80

Asp Asn His Asn Tyr Pro Ala Gln Gly Thr Val Lys Gly Thr Val Thr
85 90 95

Ser Asp Gly Ala Thr Tyr Thr Ile Trp Glu Asn Thr Arg Val Asn Glu
100 105 110

Pro Ser Ile Gln Gly Thr Ala Thr Phe Asn Gln Tyr Ile Ser Val Arg
115 120 125

Asn Ser Pro Arg Thr Ser Gly Thr Val Thr Val Gln Asn His Phe Asn
 130 135 140

Trp Ala Ser Leu Gly Leu His Leu Gly Gln Met Met Asn Tyr Gln Val
 145 150 155 160

Val Ala Val Glu Gly Trp Gly Gly Ser Gly Ser Ala Ser Gln Ser Val
 165 170 175

Ser Asn

<210> 16

<211> 190

<212> PRT

<213> Trichoderma reesei Xyl II

<400> 16

Gln Thr Ile Gln Pro Gly Thr Gly Tyr Asn Asn Gly Tyr Phe Tyr Ser
 1 5 10 15

Tyr Trp Asn Asp Gly His Gly Gly Val Thr Tyr Thr Asn Gly Pro Gly
 20 25 30

Gly Gln Phe Ser Val Asn Trp Ser Asn Ser Gly Asn Phe Val Gly Gly
 35 40 45

Lys Gly Trp Gln Pro Gly Thr Lys Asn Lys Val Ile Asn Phe Ser Gly
 50 55 60

Ser Tyr Asn Pro Asn Gly Asn Ser Tyr Leu Ser Val Tyr Gly Trp Ser
 65 70 75 80

Arg Asn Pro Leu Ile Glu Tyr Tyr Ile Val Glu Asn Phe Gly Thr Tyr
 85 90 95

Asn Pro Ser Thr Gly Ala Thr Lys Leu Gly Glu Val Thr Ser Asp Gly
 100 105 110

Ser Val Tyr Asp Ile Tyr Arg Thr Gln Arg Val Asn Gln Pro Ser Ile
 115 120 125

Ile Gly Thr Ala Thr Phe Tyr Gln Tyr Trp Ser Val Arg Arg Asn His
 130 135 140

Arg Ser Ser Gly Ser Val Asn Thr Ala Asn His Phe Asn Ala Trp Ala
 145 150 155 160

Gln Gln Gly Leu Thr Leu Gly Thr Met Asp Tyr Gln Ile Val Ala Val
 165 170 175

Glu Gly Tyr Phe Ser Ser Gly Ser Ala Ser Ile Thr Val Ser
 180 185 190

<210> 17

<211> 190

<212> PRT

<213> *Trichoderma viride*

<400> 17

Gln Thr Ile Gln Pro Gly Thr Gly Phe Asn Asn Gly Tyr Phe Tyr Ser
 1 5 10 15

Tyr Trp Asn Asp Gly His Gly Gly Val Thr Tyr Thr Asn Gly Pro Gly
 20 25 30

Gly Gln Phe Ser Val Asn Trp Ser Asn Ser Gly Asn Phe Val Gly Gly
 35 40 45

Lys Gly Trp Gln Pro Gly Thr Lys Asn Lys Val Ile Asn Phe Ser Gly
 50 55 60

Ser Tyr Asn Pro Asn Gly Asn Ser Tyr Leu Ser Val Tyr Gly Trp Ser
 65 70 75 80

Arg Asn Pro Leu Ile Glu Tyr Tyr Ile Val Glu Asn Phe Gly Thr Tyr
 85 90 95

Asn Pro Ser Thr Gly Ala Thr Lys Leu Gly Glu Val Thr Ser Asp Gly
 100 105 110

Ser Val Tyr Asp Ile Tyr Arg Thr Gln Arg Val Asn Gln Pro Ser Ile
 115 120 125

Ile Gly Thr Ala Thr Phe Tyr Gln Tyr Trp Ser Val Arg Arg Thr His
 130 135 140

Arg Ser Ser Gly Ser Val Asn Thr Ala Asn His Phe Asn Ala Trp Ala
 145 150 155 160

Gln Gln Gly Leu Thr Leu Gly Thr Met Asp Tyr Gln Ile Val Ala Val
 165 170 175

Glu Gly Tyr Phe Ser Ser Gly Ser Ala Ser Ile Thr Val Ser
 180 185 190

<210> 18

<211> 202

<212> PRT

<213> *Fibrobacter succinogenes*

<400> 18

Asn	Ser	Ser	Val	Thr	Gly	Asn	Val	Gly	Ser	Ser	Pro	Tyr	His	Tyr	Glu	1	5	10	15
Ile	Trp	Tyr	Gln	Gly	Gly	Asn	Asn	Ser	Met	Thr	Phe	Tyr	Asp	Asn	Gly	20	25	30	
Thr	Tyr	Lys	Ala	Ser	Trp	Asn	Gly	Thr	Asn	Asp	Phe	Leu	Ala	Arg	Val	35	40	45	
Gly	Phe	Lys	Tyr	Asp	Glu	Lys	His	Thr	Tyr	Glu	Glu	Leu	Gly	Pro	Ile	50	55	60	
Asp	Ala	Tyr	Tyr	Lys	Trp	Ser	Lys	Gln	Gly	Ser	Ala	Gly	Gly	Tyr	Asn	65	70	75	80
Tyr	Ile	Gly	Ile	Tyr	Gly	Trp	Thr	Val	Asp	Pro	Leu	Val	Glu	Tyr	Tyr	85	90	95	
Ile	Val	Asp	Asp	Trp	Phe	Asn	Lys	Pro	Gly	Ala	Asn	Leu	Leu	Gly	Gln	100	105	110	
Arg	Lys	Gly	Glu	Phe	Thr	Val	Asp	Gly	Asp	Thr	Tyr	Glu	Ile	Trp	Gln	115	120	125	
Asn	Thr	Arg	Val	Gln	Gln	Pro	Ser	Ile	Lys	Gly	Thr	Gln	Thr	Phe	Pro	130	135	140	
Gln	Tyr	Phe	Ser	Val	Arg	Lys	Ser	Ala	Arg	Ser	Cys	Gly	His	Ile	Asp	145	150	155	160
Ile	Thr	Ala	His	Met	Lys	Lys	Trp	Glu	Glu	Leu	Gly	Met	Lys	Met	Gly	165	170	175	
Lys	Met	Tyr	Glu	Ala	Lys	Val	Leu	Val	Glu	Ala	Gly	Gly	Gly	Ser	Gly	180	185	190	
Ser	Phe	Asp	Val	Thr	Tyr	Phe	Lys	Met	Thr							195	200		

<210> 19

<211> 189

<212> PRT

<213> *Aspergillus awamori* var. *kawachi*

<400> 19

Arg Ser Thr Pro Ser Ser Thr Gly Glu Asn Asn Gly Tyr Tyr Tyr Ser
 1 5 10 15
 Phe Trp Thr Asp Gly Gly Gly Asp Val Thr Tyr Thr Asn Gly Asn Ala
 20 25 30
 Gly Ser Tyr Ser Val Glu Trp Ser Asn Val Gly Asn Phe Val Gly Gly
 35 40 45
 Lys Gly Trp Asn Pro Gly Ser Ala Lys Asp Ile Thr Tyr Ser Gly Asn
 50 55 60
 Phe Thr Pro Ser Gly Asn Gly Tyr Leu Ser Val Tyr Gly Trp Thr Thr
 65 70 75 80
 Asp Pro Leu Ile Glu Tyr Tyr Ile Val Glu Ser Tyr Gly Asp Tyr Asn
 85 90 95
 Pro Gly Ser Gly Gly Thr Thr Arg Gly Asn Val Ser Ser Asp Gly Ser
 100 105 110
 Val Tyr Asp Ile Tyr Thr Ala Thr Arg Thr Asn Ala Pro Ser Ile Asp
 115 120 125
 Gly Thr Gln Thr Phe Ser Gln Tyr Trp Ser Val Arg Gln Asn Lys Arg
 130 135 140
 Val Gly Gly Thr Val Thr Thr Ser Asn His Phe Asn Ala Trp Ala Lys
 145 150 155 160
 Leu Gly Met Asn Leu Gly Thr His Asn Tyr Gln Ile Leu Ala Thr Glu
 165 170 175
 Gly Tyr Gln Ser Ser Gly Ser Ser Ser Ile Thr Ile Gln
 180 185

<210> 20

<211> 194

<212> PRT

<213> Thermomyces lanuginosus

<400> 20

Gln Thr Thr Pro Asn Ser Glu Gly Trp His Asp Gly Tyr Tyr Tyr Ser
 1 5 10 15
 Trp Trp Ser Asp Gly Gly Ala Gln Ala Thr Tyr Thr Asn Leu Glu Gly
 20 25 30
 Gly Thr Tyr Glu Ile Ser Trp Gly Asp Gly Gly Asn Leu Val Gly Gly
 35 40 45

Lys Gly Trp Asn Pro Gly Leu Asn Ala Arg Ala Ile His Phe Glu Gly
50 55 60

Val Tyr Gln Pro Asn Gly Asn Ser Tyr Leu Ala Val Tyr Gly Trp Thr
65 70 75 80

Arg Asn Pro Leu Val Glu Tyr Tyr Ile Val Glu Asn Phe Gly Thr Tyr
85 90 95

Asp Pro Ser Ser Gly Ala Thr Asp Leu Gly Thr Val Glu Cys Asp Gly
100 105 110

Ser Ile Tyr Arg Leu Gly Lys Thr Thr Arg Val Asn Ala Pro Ser Ile
115 120 125

Asp Gly Thr Gln Thr Phe Asp Gln Tyr Trp Ser Val Arg Gln Asp Lys
130 135 140

Arg Thr Ser Gly Thr Val Gln Thr Gly Cys His Phe Asp Ala Trp Ala
145 150 155 160

Arg Ala Gly Leu Asn Val Asn Gly Asp His Tyr Tyr Gln Ile Val Ala
165 170 175

Thr Glu Gly Tyr Phe Ser Ser Gly Tyr Ala Arg Ile Thr Val Ala Asp
180 185 190

Val Gly

<210> 21

<211> 76

<212> DNA

<213> Trx-1

<400> 21

ctagctaagg aggctgcaga tgcaaacaat acaaccagga accggttaca acaacgggta 60

cttttacagc tattgg 76

<210> 22

<211> 78

<212> DNA

<213> XyTv-2

<400> 22

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36

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[illegible]